Distribution of Oil Pools and Exploration Methods in the Kuzaykin and Sulin Devonian Graben-Like Downwarps of Tataria

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The “clastic Devonian” of Tataria was deposited in Middle Devonian and early Frasnian time of the Late Devonian. This section is most complete in the south and southeast parts of the republic, where its thickness reaches 200 m. See figure 1. Present here are deposits of the Eifelian Stage, Starooskol and Mullin Horizons, Givetian Stage, and Pashiy and Kynov Horizons of the Frasnian Stage. The section consists of alternating sand-silt rocks in the lower parts of horizons and silt-clay rocks in the upper parts. Toward the west the Eifelian, Pashiy, and lower part of the Kynov gradually drop out of the section due to erosion. In the extreme west, where thickness of the clastic Devonian does not exceed 25-30 m, the Starooskol and in places also the Mullin are missing from the section.

Commercial oil is recovered from sandstones of the Kynov (D-0), Pashiy (D-I), Mullin (D-II), Starooskol (D-III), and Vorob’yev (D-IV) Horizons.

A fundamental change in the geologic development of the study area took place in Pashiy time with the appearance of five regional graben-like downwarps - Stepnoozer, Baganin, Kuzaykin on the west and Sulin and Shaltin on the east. The first three trend north-south, and the others northeast. These downwarps extend on into Kuybyshev and Orenburg Regions and the Bashkir republic. The Baganin, Kuzaykin, and Shaltin are the best known from drilling. These are 1.5-2 km wide and more than 100 km long.

Formation of these downwarps is associated with zones of ancient basement faults. They developed in a comparatively short interval of Pashiy time and are smoothed out in the section above the Pashiy.

The Pashiy sediments thicken by as much as 50 m within these downwarps. In the southeast of the South Tatar arch sandstone content is greater within the downwarps. These sandstones shale out toward the borders; consequently, oil pools occur along the borders although there are no closed structures. On the west flank of the South Tatar arch the Pashiy sandstones pinch out, and structures become important as traps.

These downwarps are detected by common depth point seismic surveys and also by remote sensing. Drilling of seismic structures on the borders of the Kuzaykin and Baganin downwarps led discovery of new pools. A typical example is that of the Dragun seismic high. Drilling in 1988 disclosed oil pools in Kynov and Pashiy sandstones. See figure 2. A flow of 45 tons of oil per day was recovered from Stratum D-0, and 3 tons of oil and 3 tons of water per day from D-I. This suggests that only the margin of the Pashiy pool was intersected. A new well should be drilled between wells 222 and 11733 in order better to define the margin of the Kynov pool. It would be in a more favorable hypsometric position for Stratum D-1 relative to well 11733 and should produce water-free oil from the Pashiy sediments.

Figure 3 shows a typical example of pools in similar lithologic and structural-lithologic traps on the borders of the Sulin downwarp. Drilling of targets outlined by structural drilling and seismic surveys on the borders of this downwarp has led to the discovery of several such pools, the largest of which are in the Tatar-Kandyz and Matrosov fields. The latter, discovered in 1989, yielded 200 tons per day from Vorob’yev and Pashiy sandstones.

As of now eight pools have been discovered on the borders of these Devonian downwarps on the southeast flank of the South Tatar arch and about twenty pools on its west flank.

A series of wildcats was recommended for the structurally high parts of the zones of greater thickness of sandstones in the Kuzaykin downwarp. Of the first three, two failed to find commercial Devonian oil. The third yielded 10 tons per day from Stratum D-1.

Oil pools are present in Strata D-I, D-III, and D-IV in the Sulin region. Stratum D-I is the most favorable for new discoveries. Stratum D-III has a complicated lithology and limited distribution. Although D-IV has a widespread distribution, it is favorable only on the margins of structural terraces on the borders of the Sulin and Shaltin downwarps.

Lower Permian highs recommended for drilling are the Korundov, Yermetov, Makov, Generalov, and Ionov, as well as the Severo-Kislyar, which as been outlined on Horizon “D”.

Effectiveness of exploration using only seismic surveys has its limitations because the closure on Devonian structures is low and